Demonstration of ISCO Treatment of a DNAPL Source Zone at Launch Complex 34 in Cape Canaveral Air Station

Final Innovative Technology Evaluation Report

Prepared for

The Interagency DNAPL Consortium:

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Appendix G

Quality Assurance/Quality Control Information

Appendix G.1 Investigating VOC Losses During Postdemonstration Soil Core Recovery and Soil Sampling

Field procedures for collecting soil cores and soil samples from the steam injection plot were modified in an effort to minimize VOC losses that can occur when sampling soil at elevated temperatures (Battelle, 2001). The primary modifications included: (1) additional personnel safety equipment, such as thermal-insulated gloves for core handling; (2) the addition of a cooling period to bring the soil cores to approximately 20ºC before collecting samples; and (3) capping the core ends while the cores were cooling. Concerns were raised about the possibility that increased handling times during soil coring, soil cooling, and sample collection may result in an increase in VOC losses. An experiment was conducted using soil samples spiked with a surrogate compound to investigate the effectiveness of the field procedures developed for LC34 in minimizing VOC losses.

Materials and Methods

Soil cores were collected in a 2-inch diameter, 4-foot long acetate sleeve that was placed tightly inside a 2-inch diameter stainless steel core barrel. The acetate sleeve was immediately capped on both ends with a protective polymer covering. The sleeve was placed in an ice bath to cool the heated core to below ambient groundwater temperatures (approximately 20ºC). The temperature of the soil core was monitored during the cooling process with a meat thermometer that was pushed into one end cap (see Figure G-1). Approximately 30 minutes was required to cool each 4-foot long, 2-inch diameter soil core from 50-95ºC to below 20ºC (see Figure G-2). Upon reaching ambient temperature, the core sleeve was then uncapped and cut open along its length to collect the soil sample for contaminant analysis (see Figure G-3).

FIGURE G-1. A soil core capped and cooling in an ice bath. The thermometer is visible in the end cap.

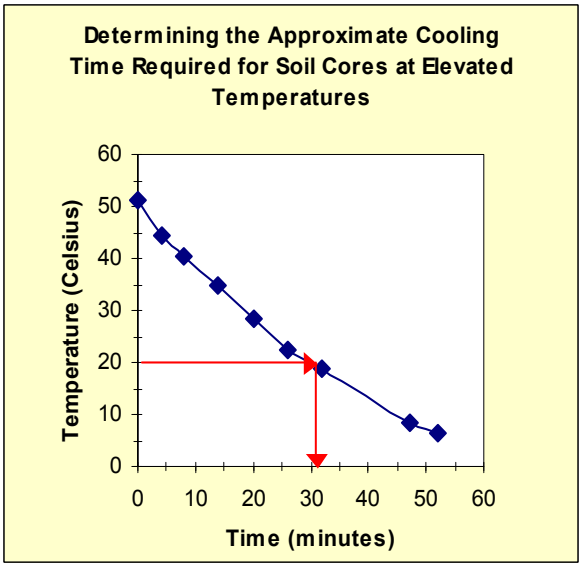

FIGURE G-2. Determining the length of time required to cool a soil core.

FIGURE G-3. A soil sample being collected from along the length of the core into a bottle 7containing methanol.

Soil samples were collected in relatively large quantities (approximately 200 g) along the entire length of the core rather than sampling small aliquots of the soil within the core, as required by the conventional method (EPA SW5035). This modification is advantageous because the resultant data provide an understanding of the continuous VOC distribution with depth. VOC losses during sampling were further minimized by placing the recovered soil samples directly into bottles containing methanol (approximately 250 mL) and extracting them on site. The extracted methanol was centrifuged and sent to an off-site laboratory for VOC analysis. The soil sampling and extraction strategy is described in more detail in Gavaskar et al. (2000).

To evaluate the efficiency of the sampling method in recovering VOCs, hot soil cores were extracted from 14 through 24 feet below ground surface and spiked with a surrogate compound, 1,1,1-trichloroethane (1,1,1-TCA). The surrogate was added to the intact soil core by using a 6" needle to inject 25 μL of surrogate into each end of the core for a total of 50 μL of 1,1,1-TCA. In order to evaluate the effect of the cooling period on VOC loss, three soil cores were spiked with TCA prior to cooling in the ice bath and three cores were spiked with TCA after cooling in the ice bath. In the pre-cooling test, the surrogate was injected as described above and the core barrels were subsequently capped and placed in the ice bath for the 30 minutes of cooling time required to bring the soil core to below 20°C. A thermometer was inserted through the cap to monitor the temperature of the soil core.

In the post-cooling test, the soil cores were injected with TCA after the soil core had been cooled in the ice bath to below 20°C. After cooling, the caps on the core barrel were removed and the surrogate compound was injected in the same manner, 25 μL per each end of the core barrel using a 6" syringe. The core was recapped and allowed to equilibrate for a few minutes before it was opened and samples were collected. Only for the purpose of the surrogate recovery tests, the entire contents of the sampling sleeve were collected and extracted on site with methanol. The soil:methanol ratio was kept approximately the same as during the regular soil sample collection and extraction. Several (four) aliquots of soil and several (four) bottles of methanol were required to extract the entire contents of the sample sleeve.

Two different capping methods were used during this experiment to evaluate the effectiveness of each cap type. Two of the soil cores were capped using flexible polymer sheets attached to the sleeve with rubber bands. The remaining four soil cores were capped with tight-fitting rigid polymer end caps. One reason that the polymer sheets were preferred over the rigid caps was that the flexible sheets were better positioned to handle any contraction of the sleeve during cooling.

Results

The results from the surrogate spiking experiment are shown in Table G-1. Soil cores 1, 3, and 5 received the surrogate spike prior to cooling in the ice bath. Soil cores 2, 4, and 6 received the surrogate spike after cooling in the ice bath. The results show that between 84 and 113% of the surrogate spike was recovered from the soil cores. Recovery comparison is not expected to be influenced significantly by soil type because all samples were collected from a fine grained to medium fine-grained sand unit. The results also indicate that the timing of the surrogate spike (i.e., pre- or post-cooling) appeared to have only a slight effect on the amount of surrogate recovered. Slightly less surrogate was recovered from the soil cores spiked prior to cooling. This implies that any losses of TCA in the soil samples spiked prior to cooling are minimal and acceptable, within the limitations of the field sampling protocol. The field sampling protocol was designed to process up to 300 soil samples that were collected over a 3-week period, during each monitoring event.

Table G-1. Recovery in Soil Cores Spiked with 1,1,1-TCA Surrogate

Soil Cores Spiked Prior to Cooling	Capping Method	1,1,1-TCA Recovery (%)	Soil Cores Spiked After Cooling	Capping Method	1,1,1-TCA Recovery (%)
Core 1	Flexible polymer sheet with rubber bands	96.3	Core 2	Flexible polymer sheet with rubber bands	98.7
Core 3	Rigid End Cap	101.0	Core 4	Rigid End Cap	112.6
Core 5	Rigid End Cap	84.3	Core 6	Rigid End Cap	109.6

The capping method (flexible versus rigid cap) did not show any clear differences in the surrogate recoveries. The flexible sheets are easier to use and appear to be sufficient to ensure good target compound recovery.

This experiment demonstrates that the soil core handling procedures developed for use at LC34 were successful in minimizing volatility losses associated with the extreme temperatures of the soil cores. It also shows that collecting and extracting larger aliquots of soil in the field is a good way of characterizing DNAPL source zones.

References

Battelle, 2001. *Quality Assurance Project Plan for Performance Evaluation of In-Situ Thermal Remediation System for DNAPL Removal at Launch Complex 34, Cape Canaveral, Florida*. Prepared by Battelle for Naval Facilities Engineering Service Center, June.

Gavaskar, A., S. Rosansky, S. Naber, N. Gupta, B. Sass, J. Sminchak, P. DeVane, and T. Holdsworth. 2000. "DNAPL Delineation with Soil and Groundwater Sampling." Proceedings of the Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, May 22-25. Battelle Press. 2(2): 49-58.

Table G-2. 1,1,1-TCA Surrogate Spike Recovery Values for Soil Samples Collected During the Steam Postdemonstration Sampling

Steam Treatment Plot: Extraction Efficiency Test **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level RPD < 30.0 %**					**Total Number of Samples Collected = 312** **Total Number of Spiked Soil Samples Analyzed = 13** **Total Number of Spiked Methanol Blanks Analyzed = 13**				
Steam Demonstration: 1,1,1-TCA Spiked Samples									
Sample ID	**Sample Date**	**1,1,1-TCA Recovery (μg)**	**1,1,1-TCA Recovery (%)**	**RPD (%)**	**Sample ID**	**Sample Date**	**1,1,1-TCA Recovery (μg)**	**1,1,1-TCA Recovery (%)**	**RPD (%)**
SB-231-2(SS)	1/30/02	1,575	118	4.4	SB-238-2(SS)	2/14/02	1,254	94	4.6
SB-231-MB(SS)[(a)]		1,509	113		SB-238-MB(SS)		1,315	98	
SB-232-2(SS)	1/29/02	1,337	100	4.0	SB-239-2(SS)	2/06/02	1,300	97	14.3
SB-232-MB(SS)		1,286	96		SB-239-MB(SS)		1,518	113	
SB-233-2(SS)	1/28/02	1,308	98	13.1	SB-240-2(SS)	2/04/02	1,073	80	3.5
SB-233-MB(SS)		1,504	112		SB-240-MB(SS)		1,112	83	
SB-234-2(SS)	2/13/02	1,220	91	5.8	SB-241-2(SS)	2/01/02	780	58	38.1
SB-234-MB(SS)		1,153	86		SB-241-MB(SS)		1,261	94	
SB-235-2(SS)	2/14/02	1,244	93	5.2	SB-242-2(SS)	1/30/02	1,082	81	8.5
SB-235-MB(SS)		1,182	88		SB-242-MB(SS)		1,182	88	
SB-236-2(SS)	2/12/02	1,324	99	1.8	SB-339-2(SS)	2/08/02	1,382	103	17.9
SB-236-MB(SS)		1,300	97		SB-339-MB(SS)		1,173	88	
SB-237-2(SS)	2/7/02	1,148	86	4.1	Range of Recovery in Soil Samples: 58-118% Average: 92%				
SB-237-MB(SS)		1,103	82						

(a) Samples listed as –MB are methanol blanks spiked with 1,1,1-TCA for the purpose of comparing to the amount of 1,1,1-TCA recovered from the soil samples.

Table G-3. Results of the Extraction Procedure Performed on PA-4 Soil Samples

Extraction Procedure Conditions	Combined
Total Weight of Wet Soil (g) = 2,124.2	1,587.8 g dry soil from PA-4 boring
Concentration (mg TCE/g soil) = 3.3	529.3 g deionized water
Moisture Content of Soil (%) = 24.9	5 mL TCE

Laboratory Extraction Sample ID	TCE Concentration in MeOH (mg/L)	TCE Mass in MeOH (mg)	TCE Concentration in Spiked Soil (mg/kg)	Theoretical TCE Mass Expected in MeOH (mg)	Percentage Recovery of Spiked TCE (%)
1st Extraction procedure on same set of samples					
SEP-1-1	1800.0	547.1	3252.5	744.11	73.53
SEP-1-2	1650.0	501.8	3164.9	701.26	71.55
SEP-1-3	1950.0	592.2	3782.3	692.62	85.51
SEP-1-4	1840.0	558.1	3340.2	739.13	75.51
SEP-1-5	1860.0	564.0	3533.9	705.91	79.89
SEP-1-6 (Control)	78.3	19.4	-	25.00	77.65
				Average % Recovery =	77.20
2nd Extraction procedure on same set of samples					
SEP-2-1	568.0	172.7	861.1	887.28	19.47
SEP-2-2	315.0	95.5	500.5	843.77	11.31
SEP-2-3	170.0	51.3	268.2	846.42	6.06
SEP-2-4	329.0	99.8	498.4	885.29	11.27
SEP-2-5	312.0	94.8	476.3	880.31	10.77
SEP-2-6 (Control)	82.6	20.4	-	25.00	81.79
				Average % Recovery =	11.78
3rd Extraction procedure on same set of samples					
SEP-3-1	55.8	17.0	84.6	885.96	1.91
SEP-3-2	59.0	17.9	94.2	841.77	2.13
SEP-3-3	56.8	17.2	90.1	846.42	2.04
SEP-3-4	63.0	19.1	95.2	888.61	2.15
SEP-3-5	52.2	15.8	80.0	875.99	1.81
SEP-3-6 (Control)	84.3	20.9	-	25.00	83.55
				Average % Recovery =	2.01

Table G-4. Results and Precision of the Field Duplicate Samples Collected During the Pre- and Post-Demonstration Soil Sampling

Oxidation Treatment Plot Field Duplicate Soil Samples QA/QC Target Level < 30.0 %				Total Number of Soil Samples Collected = 665 Total Number of Field Duplicate Samples Analyzed = 26			
Pre-Demonstration				Post-Demonstration			
Sample ID	Sample Date	Result (mg/kg)	RPD (%)	Sample ID	Sample Date	Result (mg/kg)	RPD (%)
SB-22-16	06/22/1999	2.58	22.03	SB-225-40	05/18/2000	16.35	11.99
SB-22-16B		2.07		SB-225-40B		18.43	
SB-23-34	06/23/1999	146.89	16.03	SB-219-36	05/19/2000	13.10	94.45[a]
SB-23-34B		125.10		SB-219-36B		36.55	
SB-24-42	06/25/1999	43.01	19.22	SB-223-34	05/19/2000	ND	169.11[a]
SB-24-42B		35.47		SB-223-34B		11.95	
SB-21-42	06/28/1999	5,913.59	40.44[b]	SB-224-38	05/19/2000	278.20	40.24[a]
SB-21-42B		8,911.22		SB-224-38B		185.00	
SB-19-30	06/28/1999	184.95	6.61	SB-220-34	05/20/2000	ND	0.00
SB-19-30B		173.11		SB-220-34B		ND	
SB-18-22	06/29/1999	110.06	59.70[a]	SB-218-20	05/22/2000	ND	0.00
SB-18-22B		59.46		SB-218-20B		ND	
SB-20-26	06/29/1999	179.81	2.72	SB-221-42	05/22/2000	65.26	13.66
SB-20-26B		184.76		SB-221-42B		56.91	
SB-17-34	06/30/1999	191.43	6.20	SB-217-30	05/23/2000	36.12	73.09[a]
SB-17-34B		203.68		SB-217-30B		77.72	
SB-16-12	06/30/1999	0.30	4.94	SB-317-36	05/23/2000	29.44	65.15[a]
SB-16-12B		0.28		SB-317-36B		57.89	
SB-13-32	07/01/1999	56.54	14.78	SB-213-30	05/24/2000	ND	0.00
SB-13-32B		65.56		SB-213-30B		ND	
SB-25-18	07/01/1999	1.56	41.27[a]	SB-216-28	05/24/2000	9.98	81.42[a]
SB-25-18B		2.37		SB-216-28B		23.68	
SB-14-40	07/15/1999	853.25	12.25	SB-215-34	06/01/2000	3,722.93	4.33
SB-14-40B		754.78		SB-215-34B		3,887.58	
SB-15-24	07/16/1999	240.81	6.57	SB-28-14	06/02/2000	28.35	11.88
SB-15-24B		225.50		SB-28-14B		25.17	

(a) Samples had high RPD values due to the effect of low (or below detect) concentrations of TCE drastically affected the RPD calculation.
(b) Samples had high RPD values probably due to high levels of DNAPL distributed heterogeneously through the soil core sample.

Table G-5. Results of the Rinsate Blank Samples Collected During the Post-Demonstration Soil Sampling

Total Number of Samples Collected = 357 **Total Number of Field Samples Analyzed = 7**			
Post-Demonstration Rinsate Blank Samples			
Sample ID	**Sample Date**	**Result (ug/L)**	**Comments**
RB-24-1	05/18/2000	<5.0	Met QA/QC Target Criteria
RB-23-2	05/19/2000	<5.0	Met QA/QC Target Criteria
RB-220-3	05/20/2000	<5.0	Met QA/QC Target Criteria
RB-216-4	05/22/2000	<5.0	Met QA/QC Target Criteria
RB-317-5	05/23/2000	<5.0	Met QA/QC Target Criteria
RB-213-6	05/25/2000	<5.0	Met QA/QC Target Criteria
RB-26-7	05/25/2000	<5.0	Met QA/QC Target Criteria

(a) Pre-demonstration equipment blanks were not collected.

Table G-6. Results of the Methanol Blank Samples Collected During the Pre- and Post-Demonstration Soil Sampling

Oxidation Methanol Blank Soil Extraction QA/QC Samples QA/QC Target Level < 1.0 mg/kg				**Total Number of Soil Samples Collected = 665 Total Number of Field Samples Analyzed = 26**			
Pre-Demonstration Methanol Blank Samples				**Post-Demonstration Methanol Blank Samples**			
Sample ID	**Sample Date**	**Result (mg/kg)**	**Comments**	**Sample ID**	**Sample Date**	**Result (mg/kg)**	**Comments**
SB-22-Blank	06/23/1999	<0.250	Met QA/QC Target Criteria	SB-225-Blank	05/18/2000	<0.250	Met QA/QC Target Criteria
SB-23-Blank	06/23/1999	1.800[(a)]	See footnote.	SB-223-Blank	05/19/2000	<0.250	Met QA/QC Target Criteria
SB-24-Blank	06/25/1999	<0.250	Met QA/QC Target Criteria	SB-219-Blank	05/19/2000	<0.250	Met QA/QC Target Criteria
SB-21-Blank	06/28/1999	<0.250	Met QA/QC Target Criteria	SB-224-Blank	05/20/2000	<0.250	Met QA/QC Target Criteria
SB-19-Blank	06/28/1999	0.205	Met QA/QC Target Criteria	SB-220-Blank	05/20/2000	<0.250	Met QA/QC Target Criteria
SB-18-Blank	06/29/1999	8.027[(b)]	See footnote.	SB-221-Blank	05/21/2000	<0.250	Met QA/QC Target Criteria
SB-20-Blank	06/29/1999	0.944	Met QA/QC Target Criteria	SB-218-Blank	05/22/2000	<0.250	Met QA/QC Target Criteria
SB-17-Blank	06/30/1999	0.205	Met QA/QC Target Criteria	SB-217-Blank	05/23/2000	<0.250	Met QA/QC Target Criteria
SB-16-Blank	06/30/1999	<0.250	Met QA/QC Target Criteria	SB-317-Blank	05/23/2000	<0.250	Met QA/QC Target Criteria
SB-13-Blank	07/01/1999	0.220	Met QA/QC Target Criteria	SB-216-Blank	05/24/2000	<0.250	Met QA/QC Target Criteria
SB-25-Blank	07/01/1999	<0.250	Met QA/QC Target Criteria	SB-213-Blank	05/24/2000	<0.250	Met QA/QC Target Criteria
SB-14-Blank	07/15/1999	<0.250	Met QA/QC Target Criteria	SB-214-Blank	05/31/2000	<0.250	Met QA/QC Target Criteria
SB-15-Blank	07/16/1999	1.228[(c)]	See footnote.	SB-215-Blank	06/01/2000	<0.250	Met QA/QC Target Criteria

(a) Methanol Blank sample concentrations were below 10% of the TCE results for the samples in these batches. This batch included the following set of samples: SB-23-055 through SB-23-075

(b) Methanol Blank sample concentrations were below 10% of the TCE results for the samples in these batches. This batch included the following set of samples: SB-18-293 through SB-18-317

(c) Methanol Blank sample concentrations were below 10% of the TCE results for the samples in these batches. This batch included the following set of samples: SB-15-569 through SB-15-592

Table G-7. Results and Precision of the Field Duplicate Samples Collected During the Pre- and Post-Demonstration Groundwater Sampling

Oxidation Treatment Plot Field Duplicate Groundwater Samples QA/QC Target Level < 30.0 %				Total Number of Groundwater Samples Collected = 107 (Pre-) 80 (Post-) Total Number of Field Duplicate Samples Analyzed = 9			
Pre-Demonstration				Post-Demonstration			
Sample ID	Sample Date	Result (ug/L)	RPD (%)	Sample ID	Sample Date	Result (ug/L)	RPD (%)
BAT-2S	08/05/1999	1,112,500	4.61	PA-4S	05/15/2000	<5.0	0.00
BAT-2S DUP		1,165,000		PA-4S DUP		<5.0	
BAT-5I	08/05/1999	867,500	3.40	BAT-3S	05/15/2000	630,000	4.88
BAT-5I DUP		897,500		BAT-3S DUP		600,000	
BAT-2S	08/09/1999	1,100,000	0.00	BAT-5D	05/18/2000	52,000	5.94
BAT-2S DUP		1,100,000		BAT-5D DUP		49,000	
BAT-5I	08/09/1999	960,000	23.26	PA-3S	05/18/2000	<5.0	0.00
BAT-5I DUP		760,000		PA-3S DUP		<5.0	
				PA-1I	05/19/2000	<2,000	0.00
				PA-1I DUP		<2,000	

Table G-8. Results and Precision of the Field Duplicate Samples Collected During the Oxidation Demonstration Groundwater Sampling

Oxidation Treatment Plot Field Duplicate Groundwater Samples QA/QC Target Level < 30.0 %				Total Number of Groundwater Samples Collected = 154 Total Number of Field Duplicate Samples Analyzed = 10			
Demonstration							
Sample ID	Sample Date	Result (ug/L)	RPD (%)	Sample ID	Sample Date	Result (ug/L)	RPD (%)
PA-3I	09/28/1999	1,150,000	0.87	BAT-5D	11/16/1999	730,000	0.69
PA-3I DUP		1,160,000		BAT-5D DUP		725,000	
PA-8D	09/29/1999	625,000	11.86	BAT-2I	01/12/2000	50,000	3.67
PA-8D DUP		555,000		BAT-2I DUP		48,200	
PA-8S	10/20/1999	115,000	1.75	PA-3D	01/12/2000	650,000	4.51
PA-8S DUP		113,000		PA-3D DUP		680,000	
BAT-2I	10/25/1999	68,800	12.51	BAT-5D	04/12/2000	870,000	4.49
BAT-2I DUP		60,700		BAT-5D DUP		910,000	
MP-2B	10/26/1999	290	9.01	PA-9S	04/13/2000	220,000	4.44
MP-2B DUP		265		PA-9S DUP		230,000	

Table G-9. Rinsate Blank Results for Groundwater Samples Collected for the Oxidation Pre-and Post-Demonstration Groundwater Sampling

Oxidation Pre-Demonstration Groundwater QA/QC Samples QA/QC Target Level < 3.0 ug/L			Total Number of Samples Collected = 107 (Pre-) 80 (Post-) Total Number of Rinsate Blank Samples Analyzed = 11		
Pre-Demonstration Rinsate Blanks			**Post-Demonstration Rinsate Blanks**		
Analysis Date	**TCE Concentration (ug/L)**	**Comments**	**Analysis Date**	**TCE Concentration (ug/L)**	**Comments**
08/05/1999	3,236.0	Before switching to disposal tubing.	05/16/2000	0.25	Met QA/QC Target Criteria
08/05/1999	227.0	Before switching to disposal tubing.	05/17/2000	0.33	Met QA/QC Target Criteria
08/07/1999	58.3	Before switching to disposal tubing.	05/19/2000	1.1	Met QA/QC Target Criteria
08/10/1999	2,980.0	Before switching to disposal tubing.	05/20/2000	11.0[a)]	Sampling procedure for this set repeated.
08/12/1999	140.0	Before switching to disposal tubing.			
08/12/1999	31.3	Before switching to disposal tubing.			
08/12/1999	339.0	Before switching to disposal tubing.			

a) Samples in this set included PA-12D, PA-11S, I, D. PA-11S was collected prior to the field blank, PA-11I and PA-11D were collected after, but the field blank sample was less than 10% of the concentration results in these two samples.

Table G-10. Rinsate Blank Results for Groundwater Samples Collected for the Oxidation Demonstration Groundwater Sampling

Oxidation Demonstration Groundwater QA/QC Samples QA/QC Target Level < 3.0 ug/L			Total Number of Samples Collected = 154 Total Number of Rinsate Blank Samples Analyzed = 22		
Demonstration					
Analysis Date	**TCE Concentration (ug/L)**	**Comments**	**Analysis Date**	**TCE Concentration (ug/L)**	**Comments**
09/27/1999	174.0	Before switching to disposal tubing.	10/22/1999	<2.0	Met QA/QC Target Criteria
09/27/1999	170.0	Before switching to disposal tubing.	10/26/1999	<2.0	Met QA/QC Target Criteria
09/27/1999	233.0	Before switching to disposal tubing.	10/26/1999	<2.0	Met QA/QC Target Criteria
09/28/1999	79.5	Before switching to disposal tubing.	11/16/1999	<2.0	Met QA/QC Target Criteria
09/28/1999	2,740.0	Before switching to disposal tubing.	01/11/2000	<2.0	Met QA/QC Target Criteria
09/28/1999	2,430.0	Before switching to disposal tubing.	01/12/2000	<2.0	Met QA/QC Target Criteria
09/30/1999	46.3	Before switching to disposal tubing.	01/13/2000	<3.0	Met QA/QC Target Criteria
09/28/1999	43.8	Before switching to disposal tubing.	01/14/2000	<2.0	Met QA/QC Target Criteria
09/28/1999	29.2	Before switching to disposal tubing.	04/11/2000	<1.0	Met QA/QC Target Criteria
10/06/1999	<2.0	Met QA/QC Target Criteria	04/12/2000	<1.0	Met QA/QC Target Criteria
10/07/1999	<2.0	Met QA/QC Target Criteria	04/13/2000	<1.0	Met QA/QC Target Criteria

Table G-11. Results of the Trip Blank Samples Analyzed During the Oxidation Demonstration Soil and Groundwater Sampling

Total Number of Samples Collected = 665 (Soil) 496 (Groundwater) [(a)]
Total Number of Field Samples Analyzed = 14

Oxidation Demonstration Trip Blanks							
Sample ID	**Sample Date**	**Result (ug/L)**	**Comments**	**Sample ID**	**Sample Date**	**Result (ug/L)**	**Comments**
Trip Blank-1	08/03/1999	<1.0	Met QA/QC target criteria.	Trip Blank-9	05/22/2000	<5.0	Met QA/QC target criteria.
Trip Blank-2	01/05/2000	<1.0	Met QA/QC target criteria.	Trip Blank-10	05/23/2000	<5.0	Met QA/QC target criteria.
Trip Blank-3	04/13/2000	<1.0	Met QA/QC target criteria.	Trip Blank-11	05/24/2000	<5.0	Met QA/QC target criteria.
Trip Blank-4	04/13/2000	<1.0	Met QA/QC target criteria.	Trip Blank-12	05/25/2000	<5.0	Met QA/QC target criteria.
Trip Blank-5	04/13/2000	<1.0	Met QA/QC target criteria.	Trip Blank-13	05/26/2000	<5.0	Met QA/QC target criteria.
Trip Blank-6	05/09/2000	<1.0	Met QA/QC target criteria.	Trip Blank-14	06/01/2000	<5.0	Met QA/QC target criteria.
Trip Blank-7	05/11/2000	<2.0	Met QA/QC target criteria.	Trip Blank-15	06/01/2000	<5.0	Met QA/QC target criteria.
Trip Blank-8	05/19/2000	<5.0	Met QA/QC target criteria.	Trip Blank-16	06/02/2000	<5.0	Met QA/QC target criteria.

(a) Groundwater samples that were analyzed by the on site mobile laboratory were not delivered with a trip blank sample for analysis.

Table G-12. Spike Recovery and Precision Values for Matrix Spike Samples Analyzed During the Oxidation Pre-Demonstration Soil Sampling

Oxidation Treatment Plot MS/MSD Samples **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level < 30.0 %**			**Total Number of Soil Samples Collected = 308** **Total Number of MS/MSD Samples Analyzed = 12**		
Pre-Demonstration					
Sample Date	**TCE Recovery (%)**	**RPD (%)**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
06/28/1999	113	1.5	07/07/1999	118	1.5
	115			116	
06/30/1999	123	0.03	07/09/1999	112	0.4
	123			112	
07/02/1999	91	0.26	07/09/1999	106	0.19
	92			106	
07/02/1999	118	3.6	07/13/1999	119	0.02
	114			119	
07/05/1999	100	14.0	07/16/1999	117	2.8
	82			114	
07/06/1999	104	5.2	07/22/1999	111	0.32
	110			111	

Table G-13. Spike Recovery and Precision Values for Matrix Spike Samples Analyzed During the Oxidation Post-Demonstration Soil Sampling

Oxidation Treatment Plot MS/MSD Samples **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level < 30.0 %**			**Total Number of Soil Samples Collected = 357** **Total Number of MS/MSD Samples Analyzed = 21**		
Post-Demonstration					
Sample Date	**TCE Recovery (%)**	**RPD (%)**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
05/18/2000	96	0.27	05/24/2000	93	6.80
	97			99	
05/18/2000	96	1.80	05/24/2000	100	0.12
	98			100	
05/18/2000	102	11.00	05/25/2000	134[(a)]	5.40
	91			106	
05/19/2000	87	4.40	05/25/2000	101	3.00
	94			94	
05/20/2000	91	1.80	05/26/2000	100	3.80
	93			88	
05/20/2000	100	0.56	05/31/2000	104	0.23
	100			104	
05/22/2000	88	1.80	05/31/2000	144[(a)]	2.60
	90			127	
05/22/2000	107	1.80	05/31/2000	81	5.00
	105			111	
05/22/2000	107	0.33	06/01/2000	53[(a)]	6.10
	108			73	
05/23/2000	88	2.60	06/01/2000	179[(a)]	12.00
	82			129	
05/23/2000	77	0.18			
	76				

(a) Samples had high RPD values due to the effect of low (or below detect) concentrations of TCE drastically affected the RPD calculation.

Table G-14. Spike Recovery Values for Soil Laboratory Control Spike Samples Collected for the Oxidation Pre-Demonstration

Oxidation Treatment Plot LCS/LCSD Samples **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level < 30.0 %**			**Total Number of Soil Samples Collected = 308** **Total Number of LCS/LCSD Samples Analyzed = 22**		
Pre-Demonstration					
Sample Date	**TCE Recovery (%)**	**RPD (%)**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
06/28/1999	110 105	4.6	07/06/1999	91 93	2.0
06/30/1999	121 124	2.4	07/06/1999	118 117	0.48
06/30/1999	109 108	0.46	07/07/1999	112 113	0.73
07/01/1999	122 120	1.9	07/08/1999	104 104	0.36
07/02/1999	94 95	1.6	07/09/1999	89 94	5.0
07/02/1999	92 93	0.91	07/09/1999	110 111	1.5
07/02/1999	107 110	2.5	07/12/1999	116 111	4.9
07/02/1999	118 114	3.6	07/13/1999	116 116	0.25
07/04/1999	92 96	3.9	07/14/1999	110 110	0.6
07/05/1999	110 109	0.88	07/21/1999	110 112	2.4
07/06/1999	117 118	0.76	07/24/1999	117 117	0.6

Table G-15. Spike Recovery Values for Soil Laboratory Control Spike Samples Collected for the Oxidation Post-Demonstration

Oxidation Treatment Plot LCS/LCSD Samples **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level < 30.0 %**			**Total Number of Soil Samples Collected = 357** **Total Number of LCS/LCSD Samples Analyzed = 30**		
Post-Demonstration					
Sample Date	**TCE Recovery (%)**	**RPD (%)**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
05/25/2000	96	0.27	05/31/2000	76	18.0
	97			118	
05/25/2000	96	1.8	05/31/2000	88	2.6
	98			82	
05/25/2000	102	11.0	05/31/2000	77	0.18
	91			76	
05/26/2000	100	0.56	05/31/2000	123	2.7
	100			132[(a)]	
05/26/2000	87	4.4	05/31/2000	93	6.8
	94			99	
05/28/2000	88	1.8	06/01/2000	93	6.8
	90			99	
05/28/2000	106	4.9	06/02/2000	134[(a)]	5.4
	101			106	
05/28/2000	100	1.4	06/03/2000	100	0.12
	101			100	
05/29/2000	91	1.8	06/05/2000	100	3.8
	93			88	
05/29/2000	88	1.8	06/06/2000	104	0.23
	90			104	
05/29/2000	85	6.1	06/06/2000	101	3.0
	90			94	
05/30/2000	107	1.8	06/07/2000	81	5.0
	105			111	
05/30/2000	112	0.17	06/07/2000	144[(a)]	2.6
	111			127	
05/31/2000	107	0.33	06/09/2000	96	1.2
	108			97	

(a) Outside the targeted range, but at measurable levels, given the possible matrix interference from the potassium permanganate injection.

Table G-16. Method Blank Samples Analyzed During the Oxidation Pre-Demonstration Soil Sampling

Oxidation Pre-Demonstration Soil QA/QC Samples **QA/QC Target Level < 1.0 mg/kg**			**Total Number of Samples Collected = 308** **Total Number of Method Blank Samples Analyzed = 38**		
Pre-Demonstration Method Blanks					
Analysis Date	**TCE Concentration (mg/kg)**	**Comments**	**Analysis Date**	**TCE Concentration (mg/kg)**	**Comments**
06/28/1999	<0.250	Met QA/QC Target Criteria	07/06/1999	<0.250	Met QA/QC Target Criteria
06/28/1999	<0.250	Met QA/QC Target Criteria	07/06/1999	<0.250	Met QA/QC Target Criteria
06/30/1999	<0.250	Met QA/QC Target Criteria	07/06/1999	<0.250	Met QA/QC Target Criteria
06/30/1999	<0.250	Met QA/QC Target Criteria	07/06/1999	<0.250	Met QA/QC Target Criteria
06/30/1999	<0.250	Met QA/QC Target Criteria	07/07/1999	<0.250	Met QA/QC Target Criteria
06/30/1999	<0.250	Met QA/QC Target Criteria	07/07/1999	<0.250	Met QA/QC Target Criteria
06/30/1999	<0.250	Met QA/QC Target Criteria	07/08/1999	<0.250	Met QA/QC Target Criteria
07/01/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/02/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/02/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/02/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/02/1999	<0.250	Met QA/QC Target Criteria	07/12/1999	<0.250	Met QA/QC Target Criteria
07/02/1999	<0.250	Met QA/QC Target Criteria	07/13/1999	<0.250	Met QA/QC Target Criteria
07/03/1999	<0.250	Met QA/QC Target Criteria	07/13/1999	<0.250	Met QA/QC Target Criteria
07/04/1999	<0.250	Met QA/QC Target Criteria	07/14/1999	<0.250	Met QA/QC Target Criteria
07/05/1999	<0.250	Met QA/QC Target Criteria	07/21/1999	<0.250	Met QA/QC Target Criteria
07/06/1999	<0.250	Met QA/QC Target Criteria	07/22/1999	<0.250	Met QA/QC Target Criteria
07/06/1999	<0.250	Met QA/QC Target Criteria	07/23/1999	<0.250	Met QA/QC Target Criteria
07/06/1999	<0.250	Met QA/QC Target Criteria	07/24/1999	<0.250	Met QA/QC Target Criteria
07/01/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/01/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/15/1999	<0.250	Met QA/QC Target Criteria	07/09/1999	<0.250	Met QA/QC Target Criteria
07/15/1999	<0.250	Met QA/QC Target Criteria	07/12/1999	<0.250	Met QA/QC Target Criteria

Table G-17. Method Blank Samples Analyzed During the Oxidation Post-Demonstration Soil Sampling

Oxidation Pre-Demonstration Soil QA/QC Samples **QA/QC Target Level < 1.0 mg/kg**			**Total Number of Samples Collected = 357** **Total Number of Method Blank Samples Analyzed = 36**		
Post-Demonstration Method Blanks					
Analysis Date	**TCE Concentration (mg/kg)**	**Comments**	**Analysis Date**	**TCE Concentration (mg/kg)**	**Comments**
05/25/2000	<0.250	Met QA/QC Target Criteria	05/31/2000	<0.250	Met QA/QC Target Criteria
05/25/2000	<0.250	Met QA/QC Target Criteria	06/01/2000	<0.250	Met QA/QC Target Criteria
05/25/2000	<0.250	Met QA/QC Target Criteria	05/19/2000	<0.250	Met QA/QC Target Criteria
05/26/2000	<0.250	Met QA/QC Target Criteria	06/01/2000	<0.250	Met QA/QC Target Criteria
05/27/2000	<0.250	Met QA/QC Target Criteria	06/01/2000	<0.250	Met QA/QC Target Criteria
05/27/2000	<0.250	Met QA/QC Target Criteria	06/02/2000	<0.250	Met QA/QC Target Criteria
05/28/2000	<0.250	Met QA/QC Target Criteria	06/02/2000	<0.250	Met QA/QC Target Criteria
05/28/2000	<0.250	Met QA/QC Target Criteria	06/03/2000	<0.250	Met QA/QC Target Criteria
05/28/2000	<0.250	Met QA/QC Target Criteria	06/05/2000	<0.250	Met QA/QC Target Criteria
05/29/2000	<0.250	Met QA/QC Target Criteria	06/06/2000	<0.250	Met QA/QC Target Criteria
05/29/2000	<0.250	Met QA/QC Target Criteria	06/07/2000	<0.250	Met QA/QC Target Criteria
05/30/2000	<0.250	Met QA/QC Target Criteria	06/07/2000	<0.250	Met QA/QC Target Criteria
05/30/2000	<0.250	Met QA/QC Target Criteria	06/07/2000	<0.250	Met QA/QC Target Criteria
05/30/2000	<0.250	Met QA/QC Target Criteria	06/07/2000	<0.250	Met QA/QC Target Criteria
05/30/2000	<0.250	Met QA/QC Target Criteria	06/07/2000	<0.250	Met QA/QC Target Criteria
05/31/2000	<0.250	Met QA/QC Target Criteria	06/08/2000	<0.250	Met QA/QC Target Criteria
05/31/2000	<0.250	Met QA/QC Target Criteria	06/09/2000	<0.250	Met QA/QC Target Criteria
05/31/2000	<0.250	Met QA/QC Target Criteria	06/01/2000	<0.250	Met QA/QC Target Criteria

Table G-18. Spike Recovery and Precision Values for Matrix Spike Samples Analyzed During the Oxidation Demonstration Groundwater Sampling

Oxidation Treatment Plot Groundwater QA/QC **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level RPD < 30.0 %**							
Oxidation Demonstration Matrix Spike Samples							
Sample ID	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**	**Sample ID**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
BAT-2S MS	08/03/1999	104	0.11	MP-2C MS	10/26/1999	109	0.4
BAT-2S MSD		103		MP-2C MSD		109	
BAT-5I MS	08/03/1999	51[(a)]	5.6	ML-2 MS	01/14/2000	181[(a)]	6.63
BAT-5I MSD		27[(a)]		ML-2 MSD		202[(a)]	
PA-7D MS	08/07/1999	92.0	0.6	PA-3D DUP MS	01/15/2000	130	0.874
PA-7D MSD		96.0		PA-3D DUP MSD		126	
MP-3A MS	09/30/1999	89	4.3	PA-1D MS	01/16/2000	94	3.56
MP-3A MSD		82		PA-1D MSD		98	
ML-2 MS	10/25/1999	116	0.9	PA-8S MS	06/15/2000	78	12.0
ML-2 MSD		115		PA-8S MSD		88	

(a) TCE recovery was affected by interference from excess potassium permanganate in these groundwater samples.

Table G-19. Spike Recovery and Precision Values for Laboratory Control Spike Samples Analyzed During the Pre- and Post-Demonstration Groundwater Sampling

Oxidation Treatment Plot Groundwater QA/QC **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level RPD < 30.0 %**				**Total Number of Samples Collected = 107 (Pre-) 80 (Post-)** **Total Number of Matrix Spike Samples Analyzed = 18**			
Pre-Demonstration LCS/LCSD Samples				**Post-Demonstration LCS/LCSD Samples**			
Sample ID	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**	**Sample ID**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
LCS-990805	08/05/1999	115	5.9	DD6K8102-LCS	05/15/2000	91	2.6
LCSD-990805		122		DD6K8103-LCSD		93	
LCS-990806	08/06/1999	107	3.1	DD7JQ102-LCS	05/16/2000	93	3.6
LCSD-990806		111		DD7JQ103-LCSD		97	
LCS-990807	08/07/1999	113	0.4	DDC22102-LCS	05/18/2000	94	1.9
LCSD-990807		113		DDC22103-LCSD		93	
LCS-990809	08/09/1999	109	2.0	DDDEQ102-LCS	05/18/2000	96	1.2
LCSD-990809		106		DDDEQ103-LCSD		97	
LCS-990810	08/10/1999	111	2.5	DDF78102-LCS	05/19/2000	84	2.9
LCSD-990810		109		DDF78103-LCSD		87	
LCS-990811	08/11/1999	112	3.8	DDG8R102-LCS	05/20/2000	100	4.2
LCSD-990811		108		DDG8R103-LCSD		95	
LCS-990812	08/12/1999	106	0.6	DDH5F102-LCS	05/21/2000	97	4.9
LCSD-990812		105		DDH5F103-LCSD		92	
LCS-990813	08/13/1999	98	4.0	DDH76102-LCS	05/22/2000	90	1.1
LCSD-990813		102		DDH76103-LCSD		91	
				DF2FM102-LCS	06/20/2000	84	11.0
				DF2FM103-LCSD		94	
				DF4F5102-LCS	06/21/2000	89	0.88
				DF4F5103-LCSD		88	

Table G-20. Spike Recovery and Precision Values for Laboratory Control Spike Samples Analyzed During the Oxidation Demonstration Groundwater Sampling

Oxidation Treatment Plot Groundwater QA/QC **QA/QC Target Level Recovery % = 70 – 130 %** **QA/QC Target Level RPD < 30.0 %**				**Total Number of Samples Collected = 309** **Total Number of Matrix Spike Samples Analyzed = 15**			
Demonstration LCS/LCSD Spike Samples							
Sample ID	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**	**Sample ID**	**Sample Date**	**TCE Recovery (%)**	**RPD (%)**
LCS-990927	09/27/1999	95	12.1	LCS-991025	10/25/1999	113	0.9
LCSD-990927		107		LCSD-991025		112	
LCS-990928	09/28/1999	113	5.1	LCS-991026	10/26/1999	112	4.6
LCSD-990928		107		LCSD-991026		107	
LCS-990929	09/29/1999	107	4.2	LCS-991118	11/18/1999	109	17.6
LCSD-990929		111		LCSD-991118		91	
LCS-991018	10/18/1999	114	1.4	LCS-00113	01/13/2000	101	-
LCSD-991018		115		LCSD-00113		-	
LCS-991019	10/19/1999	119	6.2	LCS-00114	01/14/2000	106	-
LCSD-991019		112		LCSD-00114		-	
LCS-991020	10/20/1999	109	9.8	LCS-00115	01/15/2000	113	1.16
LCSD-991020		99		LCSD-00115		103	
LCS-991021	10/21/1999	111	5.3	LCS-00116	01/16/2000	104	1.94
LCSD-991021		117		LCSD-00116		102	
LCS-991022	10/22/1999	108	3.3				
LCSD-991022		112					

Table G-21. Method Blank Samples Analyzed During the Oxidation Pre-Demonstration Groundwater Sampling

Oxidation Pre- and Post-Demo Groundwater QA/QC Samples QA/QC Target Level < 3.0 ug/L			Total Number of Samples Collected = 107 (Pre-) 80 (Post-) Total Number of Method Blank Samples Analyzed = 18		
Pre-Demonstration Method Blanks			**Post-Demonstration Method Blanks**		
Analysis Date	**TCE Concentration (ug/L)**	**Comments**	**Analysis Date**	**TCE Concentration (ug/L)**	**Comments**
08/05/1999	<2.0	Met QA/QC Target Criteria	08/09/1999	<1.0	Met QA/QC Target Criteria
08/06/1999	<2.0	Met QA/QC Target Criteria	05/15/2000	<1.0	Met QA/QC Target Criteria
08/07/1999	<2.0	Met QA/QC Target Criteria	05/16/2000	<1.0	Met QA/QC Target Criteria
08/08/1999	<2.0	Met QA/QC Target Criteria	05/18/2000	<1.0	Met QA/QC Target Criteria
08/09/1999	<2.0	Met QA/QC Target Criteria	05/18/2000	<1.0	Met QA/QC Target Criteria
08/10/1999	<2.0	Met QA/QC Target Criteria	05/19/2000	<1.0	Met QA/QC Target Criteria
08/11/1999	<2.0	Met QA/QC Target Criteria	05/20/2000	<1.0	Met QA/QC Target Criteria
08/12/1999	<2.0	Met QA/QC Target Criteria	05/21/2000	<1.0	Met QA/QC Target Criteria
08/09/1999	<1.0	Met QA/QC Target Criteria	05/22/2000	<1.0	Met QA/QC Target Criteria

Table G-22. Method Blank Samples Analyzed During the Oxidation Demonstration Groundwater Sampling

Oxidation Demonstration Groundwater QA/QC Samples QA/QC Target Level < 3.0 ug/L			Total Number of Samples Collected = 309 Total Number of Method Blank Samples Analyzed = 21		
Demonstration					
Analysis Date	**TCE Concentration (ug/L)**	**Comments**	**Analysis Date**	**TCE Concentration (ug/L)**	**Comments**
09/27/1999	<2.0	Met QA/QC Target Criteria	11/16/1999	<2.0	Met QA/QC Target Criteria
09/28/1999	<2.0	Met QA/QC Target Criteria	01/13/2000	<2.0	Met QA/QC Target Criteria
09/29/1999	<2.0	Met QA/QC Target Criteria	01/14/2000	<2.0	Met QA/QC Target Criteria
09/30/1999	<2.0	Met QA/QC Target Criteria	01/15/2000	<2.0	Met QA/QC Target Criteria
10/06/1999	<2.0	Met QA/QC Target Criteria	01/16/2000	<2.0	Met QA/QC Target Criteria
10/07/1999	<2.0	Met QA/QC Target Criteria	01/17/2000	<2.0	Met QA/QC Target Criteria
10/20/1999	<2.0	Met QA/QC Target Criteria	04/11/2000	<1.0	Met QA/QC Target Criteria
10/21/1999	<2.0	Met QA/QC Target Criteria	04/13/2000	<1.0	Met QA/QC Target Criteria
10/22/1999	<2.0	Met QA/QC Target Criteria	04/18/2000	<1.0	Met QA/QC Target Criteria
10/25/1999	<2.0	Met QA/QC Target Criteria	04/21/2000	<1.0	Met QA/QC Target Criteria
10/26/1999	<2.0	Met QA/QC Target Criteria			

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CHAIN-OF-CUSTODY

CLIENT: BATTELLE
ADDRESS: 505 KING AVE
PHONE: 614 424 4569 FAX 614 424 3667
DATA REPORTED TO: SAM YOON
ADDITIONAL REPORT COPIES TO: EDD FORMAT

DATE: 11/8/01 PAGE 1 OF 2
PO #: DHL WORK ORDER #: 0111041
PROJECT LOCATION OR NAME: CCAS
CLIENT PROJECT #: COLLECTOR: ED, JS

Authorize 5% surcharge for TRRP report? ☐ Yes ☐ No

S=SOIL W=WATER A=AIR P=PAINT SL=SLUDGE OT=OTHER

PRESERVATION: HCl | HNO_3 | H_2SO_4 ☐ NaOH ☐ | ICE | UNPRESERVED

ANALYSES: BTEX ☐ MTBE ☐ | TRPH 418.1 ☐ TPH 1005 ☐ TPH 1006 ☐ | GASOLINE MOD 8015 ☐ | DIESEL - MOD 8015 ☐ | VOC 8260 ☐ SEE LIST | SVOC 8270 ☐ PAH 8270 ☐ | 8081 PESTICIDES ☐ 8151 HERBICIDES ☐ | 8082 PCBS ☐ | TCLP - METALS (RCRA) ☐ TCLP VOC ☐ | TCLP - PEST ☐ HERB ☐ Semi-VOC ☐ | TOTAL METALS (RCRA) ☐ OTHER LIST ☐ | LEAD - TOTAL ☐ D.W. 200.8 ☐ TCLP ☐ | RGI ☐ TOX ☐ FLASHPOINT ☐ | TDS ☐ TSS ☐ % MOISTURE ☐ | pH ☐ HEXAVALENT CHROMIUM ☐ | EXPLOSIVES ☐ PECHLORATE ☐ | CHLORIDE ☐ ANIONS ☐ ALKALINITY ☐

Field Sample I.D.	DHL Lab #	Date	Time	Matrix	Container Type	# of Containers	HCl	HNO_3	H_2SO_4 ☐ NaOH ☐	ICE	UNPRESERVED	VOC 8260 ☐ SEE LIST	FIELD NOTES
BAT-3S	01A	11/7/01	09:00	W	40 mL VOA	3	X					X	SEE LIST FOR VOCs to be analyzed.
BAT-3I	02A		09:30	W		3	X					X	
BAT-3D	03A		10:00	W		3	X					X	
PA-20	04A		11:00	W		3	X					X	
PA-21	05A		10:30	W		3	X					X	
PA-22	06A		14:00	W		3	X					X	
PA-14S	07A		15:00	W		3	X					X	
PA-14S DUP	08A		15:00	W		3	X					X	
PA-14I	09A		15:30	W		3	X					X	
PA-14D	10A		16:00	W		3	X					X	
PA-18S	11A		16:30	W		3	X					X	
PA-18I	12A		17:00	W		3	X					X	
PA-18D	13A	↓	17:30	W		3	X					X	
Trip Blank	14A	11/8/01	10:00	W		2	X					X	
Ringate-1	15A	11/7	830	W	↓	0	X					X	

TOTAL 41

RELINQUISHED BY: (Signature) E. Dunlap DATE/TIME 11/8/01 10:00 RECEIVED BY: (Signature) Fed Ex 1
RELINQUISHED BY: (Signature) Fed Ex DATE/TIME 11/9/01 9:00 AM RECEIVED BY: (Signature)
RELINQUISHED BY: (Signature) DATE/TIME RECEIVED BY: (Signature)

☐ DHL DISPOSAL @ $5.00 each ☐ Return ☐ Pickup

TAT
RUSH ☐ CALL FIRST
1 DAY ☐ CALL FIRST
2 DAY ☐
NORMAL ☒
OTHER ☐ ____

LABORATORY USE ONLY:
RECEIVING TEMP: 2.3, 1.6 °C Temp Blank
CUSTODY SEALS - ☐ BROKEN ☐ INTACT ☒ NOT USED
☒ CARRIER BILL # Fed Ex 823984123806
☐ PICKED UP BY DHL ANALYTICAL STAFF
☐ HAND DELIVERED